

Modified SEIR and AI prediction of the epidemics trend of COVID-19 in China under public health interventions

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Abstract

Background The coronavirus disease 2019 (COVID-19) outbreak originating in Wuhan, Hubei province, China, coincided with chunyun, the period of mass migration for the annual Spring Festival. To contain its spread, China adopted unprecedented nationwide interventions on January 23 2020. These policies included large-scale quarantine, strict controls on travel and extensive monitoring of suspected cases. However, it is unknown whether these policies have had an impact on the epidemic. We sought to show how these control measures impacted the containment of the epidemic. **Methods** We integrated population migration data before and after January 23 and most updated COVID-19 epidemiological data into the Susceptible-Exposed-Infectious-Removed (SEIR) model to derive the epidemic curve. We also used an artificial intelligence (AI) approach, trained on the 2003 SARS data, to predict the epidemic. **Results** We found that the epidemic of China should peak by late February, showing gradual decline by end of April. A five-day delay in implementation would have increased epidemic size in mainland China three-fold. Lifting the Hubei quarantine would lead to a second epidemic peak in Hubei province in mid-March and extend the epidemic to late April, a result corroborated by the machine learning prediction. **Conclusions** Our dynamic SEIR model was effective in predicting the COVID-19 epidemic peaks and sizes. The implementation of control measures on January 23 2020 was indispensable in reducing the eventual COVID-19 epidemic size.